Box A 72
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ILLUSTRATIONS

TO BE EMPLOYED IN

PRACTICAL LESSONS ON BOTANY.

ADAPTED TO BEGINNERS OF ALL CLASSES.

PREPARED FOR THE

SOUTH KENSINGTON MUSEUM,

BY THE

REV. PROFESSOR HENSLOW,

RECTOR OF HITCHAM, SUFFOLK.

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PRACTICAL LESSONS ON BOTANY.

In order to employ Botany as a strictly *educational* weapon, we must not confine ourselves to telling children the names of plants, how they may be artificially grouped, what properties they possess, or the few physiological facts hitherto established with more or less precision respecting them. We may give any one valuable instruction of this description, either orally or by books, without having exacted the requisite attention to the *structure* of plants, which demands a personal observation of facts, and a decided mental effort to derive just inferences from that kind of *circumstantial* evidence which such facts afford in regard to their affinities. Experience has satisfied me that "Structural Botany" may be more conveniently and extensively employed than any other branch of natural science, for strengthening the "observant faculties," and expanding the "reasoning powers" of children, in all classes of society. But, in order to secure a beneficial result of this sort, we must not avoid the use of certain technical expressions, however pedantically unnecessary they may appear to persons unacquainted with their importance, and unaccustomed to their use. Scientifically accurate ideas must always be conveyed, either by entirely new words, or by peculiar technical meanings assigned to old words. Botanists employ both methods. Some of the most important technical terms have not been judiciously selected. Some are too long, others harsh and ungrammatical. But the few terms to which these objections apply cannot be satisfactorily dispensed with. They are thoroughly established, and are, in fact, much more readily learnt than might be imagined.

ILLUSTRATION I.

The Printed Scheme for Monday Lessons.

VILLAGE-SCHOOL BOTANY.

Children wishing to learn Botany will be placed in the 3rd Class when they shall have learnt to spell correctly the following words:

Class. (*I. Exercise.*)	Division. (*II. Exercise.*)	Section. (*IV. Exercise.*)
1. Dicotyledons.	1. Angiospermous.	1. Thalamifloral. 2. Calycifloral. 3. Corollifloral. (*V. Exercise.*)
	2. Gymnospermous.	4. Incomplete.
	(*III. Exercise.*)	
2. Monocotyledons.	1. Petaloid.	1. Superior 2. Inferior.
	2. Glumaceous.	
3. Acotyledons.		

Children in the 3rd Class who have learnt how to fill in the first column of the Floral Schedule, and to spell correctly the following words, will be raised to the Second Class:

Pistils & Carpels } of Ovary (with Ovules), Style, and Stigma.

Stamens, of Filament and Anther (with Pollen).

Corolla, of Petals
Calyx, of Sepals } or Perianth, of Leaves.

Children of the 2nd Class who have learnt how to fill in the second column of the Floral Schedule, and to spell correctly the following words, will be raised to the First Class:

	V. C.	V. C.	V. C.
C. Mono-di-&c. to poly-phyllous, -sepalous, -petalous, -gynous.	0. An— A—	5. Pent—	10. Dec—
V. Mon-di-&c. to poly-androus, -adelphous.	1. Mon— o—	6. Hex—	11. Endec— a—
Di-, tetra-dynamous	2. Di— —	7. Hept— a—	12. Dodec—
Syngenesious.	3. Tri— —	8. Oct—	20. Icos—
	4 Tetr— a—	9. Enne—	∞. Poly— —

Children of the 1st Class will learn to fill in the third column of the Floral Schedule, and to spell correctly the following words:

Hypogynous.
Perigynous.
Epigynous.

Epipetalous.
Gynandrous.

Monday Botanical Lessons at 3 P.M., at the School, to include,

1st. Inspection of a few species, consecutively, in the order on the plant-list. Anything of interest in their structure or properties will then be noticed.

2nd. Hard word exercises. Two or three words named one Monday are to be correctly spelt the next Monday.

3rd. Specimens examined, and the parts of the flower laid in regular order upon the dissecting-boards. The Floral Schedule to be traced upon the slates, and filled up as far as possible. Marks to be allowed according to the following scale:

	No.	Cohesion, Proportion.	Adhesion (Insertion).	Classification.
P	1	a-, mono-&c. gynous 2	Superior or	
C	3		Inferior 2	
				Class 1
St.	1	an-, mon-&c. androus 2	Hypo-&c. gynous 4	Division 2
f.—	1	mon-&c. adelphous 3	Epipetalous 4	Section 3
		Di-, tetra, -dynamous 3		Order 4
a.—	1	Syngenesious 2	Gynandrous 3	Genus 3
				Species 2
C. P.	1	a-, mono-&c. petalous 2	Hypo-&c. gynous 4	
C. S.	1	a-, mono-&c. sepalous 2	Inferior or	
or P. L.	1	a-, mono-&c. phyllous 2	Superior 2	

4th. Questions respecting Root; Stems and Buds; Leaf and Stipules; Inflorescence and Bracts; Flower and Ovules; Fruit; Seed and Embryo.

Regulations respecting Botanical Prizes and Excursions.

Prizes awarded according to the joint number of marks obtained at Monday Lessons, from Schedule Labels filled in at home, and for species first found in flower during the season.

Botanical Excursions attended only by those who obtain a sufficient number of marks at Monday Lessons. Two Pic-nic Excursions during the summer, within the precincts of the parish, open to children in each of the three classes. Other excursions within the parish are open only to those of the second and first classes. An excursion to a distance from the parish for those of the first class only who obtain the requisite marks.

The first class may attend (at the proper season) at the Rectory on Sundays, after Divine Service in the afternoon. Objects of Natural History, in the Animal, Vegetable, and Mineral Kingdoms will then be exhibited, and such accounts given of them as may tend to improve our means of better appreciating the wisdom, power, and goodness of the Creator.

A copy of the above scheme is given to every child, however young, who is ambitious of being classed as a volunteer botanist. The mode of employing it will be apparent as we proceed with the descriptions of these Illustrations.

ILLUSTRATION II.

The Hitcham Plant List in Print.

BRITISH PLANTS,

Growing Wild (and a few Common Trees in Plantations), in the parish of Hitcham, Suffolk. By the Rev. J. S. Henslow.

The numbering of the Orders, Genera, and Species agrees with Hooker and Arnott's "British Flora." The Orders have been *anglicised* by changing the terminations of the genitive cases of their typical genera into "anths" (*flowers*): thus, 1. Ranuncul-i, Ranunculanths; 2. Berberid-is, Berberidanths; 5. Fumari-æ, Fumarianths, &c. Where a typical genus occurs in the list, its Latin name is added in a bracket.

An asterisk (*) indicates the species regarded as not indigenous.

CLASS I. DICOTYLEDONS.
DIVISION I. ANGIOSPERMOUS.
Section 1. Thalamifloral.
ORDER 1. RANUNCULANTHS.
Genus 1. Traveller's Joy
Species 1. *common*
&c. &c. &c.

Section 2. Calycifloral.
(*Polypetalous.*)
ORDER 24. CELASTRANTHS.
Gen. 1. Spindle-tree
Sp. 1. *common*
&c. &c. &c.

Section 3. Corollifloral.
ORDER 53. ILICANTHS.
Gen. 1. Holly (Ilex)
Sp. 1. *common*
&c. &c. &c.

Section 4. Incomplete.
ORDER 70. CHENOPODIANTHS.
Gen. 2. Goosefoot (Chenopodium)
Sp. 2. *many-seeded*
var. *acute*
6. *white*
7. *red*
10. *mercury*
&c. &c. &c.

DIV. II. GYMNOSPERMOUS.
ORDER 87. CONIFERS, or PINANTHS.
Gen. 1. Fir (Pinus)
**Sp.* 1. *scotch*
———. **norway-spruce*
———. **larch*
Gen. 3. Yew
**Sp.* 1. *common*

CLASS II. MONOCOTYLEDONS.
DIV. I. PETALOID.
Section 1. Superior.
ORDER 88. HYDROCHARIDANTHS.
Gen. 1. Anacharis
**Sp.* 1. *long-flowered*
&c. &c. &c.

Section 2. Inferior.
ORDER 93. PARIDANTHS.
Gen. 1. Herb-Paris (Paris)
Sp. 1. *common*
&c. &c. &c.

DIV. II. GLUMACEOUS.
ORDER 106. SEDGES, or CYPERANTHS.
Gen. 6. Spike-rush
Sp. 1. *creeping*

CLASS III. ACOTYLEDONS.
DIV. I. FILICAL.
ORDER 108. FERNS.
Gen. 2. Polypody
Sp. 1. *common*
&c. &c. &c.

DIV. II. MUSCAL
DIV. III. FUNGAL
DIV. IV. ALGAL

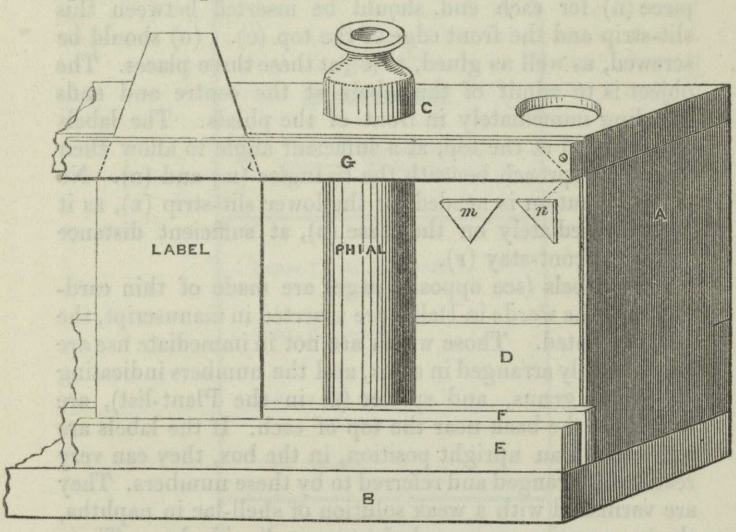
A copy of this Plant-list is given to every child who has fought its way into the third class, and can write down from memory the thirteen words of the five exercises at the top of Illustration I.

The chief use to be made of this Plant-list will be explained under Illustration VIII.

ILLUSTRATION III.

Plant Stand and Labels.

The Plant Stands are easily and cheaply constructed of eight thin strips of deal.



END OF A PLANT STAND.

A.	One of the two end pieces	$\frac{1}{2}$	in. thick,	3	in. long,	2	in. wide
B.	Base	do.	„	36	„	$2\frac{3}{5}$	„
C.	Top	do.	„	do.	„	2	„
D.	Back-stay	do.	„	do.	„	1	„
E.	Lower slit-strip . .	do.	„	do.	„	$\frac{1}{2}$	„
F.	Front-stay	$\frac{1}{4}$	„	do.	„	$\frac{1}{4}$	„
G.	Upper slit-strip . .	do.	„	do.	„	do.	„

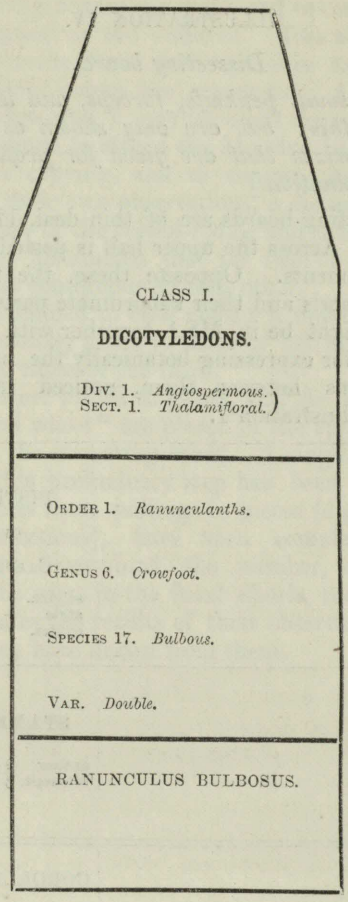
The top (c) is perforated by a centre-bit to receive eighteen common cast phials 1 inch diameter. The holes should be a trifle wider. The two outermost must be half the distance from the ends of the plant-stand which they all are between each other, in order to secure a uniform range from stand to stand. There will thus be 4 inches between

the axes of contiguous phials. Sixteen plant-stands will carry half a gross of phials, rather more than the number of wild-flowers likely to be obtained in blossom at the same time. The phials and labels are easily re-adjusted, according as the specimens in particular parts of the series may require.

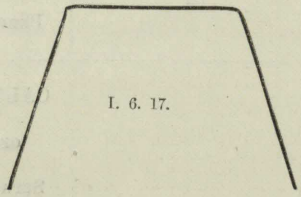
To adjust the upper slit-strip (G), behind which the labels are slipped, a thin equilateral triangular piece of wood (m), for the middle of the stand, and a right-angled triangular piece (n) for each end, should be inserted between this slit-strip and the front edge of the top (C). (G) should be screwed, as well as glued, to (C), at these three places. The object is to admit of the labels at the centre and ends standing immediately in front of the phials. The labels are trimmed at the top, at a sufficient angle to allow their edges to approach beneath the triangles (m) and (n). No such precaution is needed for the lower slit-strip (E), as it rests immediately on the base (B), at sufficient distance from the front-stay (F).

The Labels (see opposite page) are made of thin card-board. The words in Italics are inserted in manuscript, the rest is printed. Those which are not in immediate use are methodically arranged in a box, and the numbers indicating the order, genus, and species (as in the Plant-list), are written at the back near the top of each. If the labels are put away in an upright position, in the box, they can very readily be arranged and referred to by these numbers. They are varnished with a weak solution of shell-lac in naphtha, the preparation commonly known as liquid-glue. Those who object to the smell of naphtha can dissolve the shell-lac in alcohol. They are most conveniently prepared by first dipping one end, allowing it to dry, and then dipping the rest in the solution. The junction line of the two immersions should lie at the bottom of the sloped end of the label; in order that it may be concealed behind the upper slit-strip (G), when the label is placed before a phial.

The children are required to bring fresh specimens of all the wild-flowers they can procure, in order to keep up the display; but only those who are well acquainted with their names are authorised to place them in their proper phials.



SIZE OF A LABEL.



AT BACK OF THE LABEL.

ILLUSTRATION IV.

Dissecting-board.

[*N.B. A small penknife, forceps, and lens are exhibited upon this; but are only shown as examples of the sort of prizes that are given for proficiency at the Annual examination.*]

The Dissecting-boards are of thin deal, 12 inches long and 9 wide. Across the upper half is pasted a paper with four compartments. Opposite these, the names of the four floral whorls and their subordinate parts are printed (the whole might be in MS.), together with the adjective terminations for expressing botanically the numerical and other relations between them, noticed in the floral schedule on Illustration I.

No.			
		PISTILS OF CARPELS. stigma. style. ovules. } ovary.	—*gynous.*
		STAMENS. anther. filament. } pollen.	—*androus.*
		COROLLA OF PETALS.	—*petalous.*
		CALYX OF SEPALS.	—*sepalous.*
			PERIANTH OF LEAVES. —*phyllous.*

The Dissecting-boards are numbered to correspond with numbers assigned to the children. This affords a ready method of referring from their exercises to the lists in which their merit marks are registered. A child retains the same number after it may have left the school, so long as it shall continue to attend the Monday Lessons.

To prevent copying, and to compel the children to depend upon their own observations, a distinct position is assigned to each in the school-room; and those of different classes are so intermixed that no two of the first and second class sit contiguous to each other.

A flower is handed to each child: a more difficult specimen being usually given to those of the first and second classes than to those of the third.

The flowers are pulled to pieces, and the separate parts of each "floral whorl" are placed in the appropriate compartments on the dissecting-board. A single glance shows me whether this preliminary step has been properly performed. When these pullings to pieces (dignified by the name of dissections), have been completed, and the children have determined the number, cohesion, and insertion of the parts in the floral whorls, they next record upon their slates the results of their observations, and the inferences they have drawn from them.

ILLUSTRATION V.

A School Slate, with an Example of a Floral Schedule Exercise prepared by one of the Children, aged 15 (*the Pupil-teacher*).

				Cl. Dicotyledons.
$\frac{P}{C}$	$\frac{1}{2}$	*Monogynous.*	*Superior.*	*Div. Angiospermous.*
St.	6	*Tetradynamous.* *Hexandrous.*	*Hypogynous.*	*Sec. Thalamifloral.*
C.P.	4	*Tetrapetalous.*	*Hypogynous.*	*Or. Brassicanths.*
C.S.	4	*Tetrasepalous.*	*Inferior.*	*Gen. Wallflower.*
Harriet Sewell. No. 7.				*Sp. Common.*

The Scheme at Illustration I. will show how much of this schedule is expected of children in the second and third classes.

The children rule their slates for this exercise before they begin to dissect, the elder often assisting the younger.

As the children severally complete this exercise, they deposit their slates in one part of the school, and walk into a contiguous class-room, fitted with the usual school-gallery, one bench above another. The slates are conveyed to the Rectory, and are inspected the same evening. Errors are corrected, marks assigned for merit, and a few comments made upon the slates in some cases. The slates are returned to the School on Tuesday morning, when the School-mistress or the Pupil-teacher, reads aloud the remarks. They may be some such as follows :—

No. *.—Good girl, has evidently taken pains, though wrong in two particulars.

„ *.—Idle! Idle! Idle! not only no marks, but loses one for *carelessness*. Has forgotten to sign his name and give his number!

No. *.—You describe your flower as having pentapetalous hypogynous corolla, and class it under section Corollifloral! But corollifloral flowers have their corolla monopetalous as well as hypogynous, except in a case or two, which do not belong to Hitcham plants. Look at your Plant-list, and see the section in which this order, which you have rightly named, is classed.

„ *.—Ask me, when I next come to the school, to show you why your plant is not a Papaveranth, as you suppose.

„ *.—You must work harder if you wish to be classed. Wrong for three Mondays in the second Exercise of only two words! No. *, who began to try at the same time as yourself, and is much younger, got classed in three weeks, and will soon get into the second class.

ILLUSTRATION VI.

Suspending-rod for exhibiting dried Specimens and Diagrams.

The Class-room in which the children take their seats, after they have finished the above exercise, is fitted up with the Plant Stands (Illustration II.). Before them hang two or more suspending-rods for exhibiting dried specimens from the school Herbarium, diagrams, plates, and other illustrations, as occasion may require.

The suspending-rods are of deal 6 feet long, 1 in. broad, and ½ in. thick. They are pierced with three holes, one at each end and one in the middle, through which a looped piece of tape or string is passed for the purpose of hanging them to hooks or nails. Small brass brads are nailed near the lower edge, at intervals of 3 inches apart, from one end to the other; and hooks (known among hooks and eyes) at 6 inches apart near the upper edge, above the spaces between the brads. The hooks are intended for suspending diagrams or any more weighty matters, whilst

the studs (with roundish heads) serve for the herbarium specimens, each of which has two small holes punched near the top of the paper on which it is glued at 6 inches apart. They are thus readily slipped on and off the brass studs.

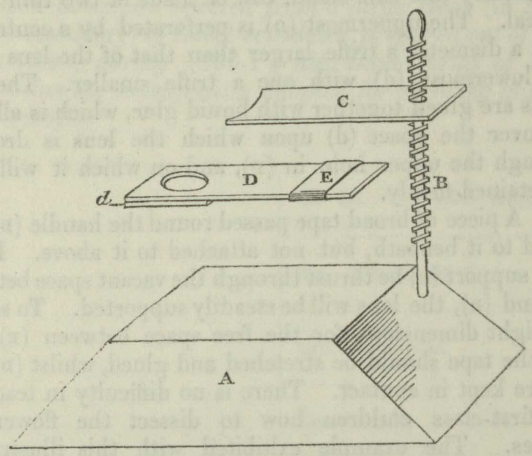
A few specimens from the herbarium are exhibited. These are selected in regular sequence. Where an Order is so extensive that all the species cannot be exhibited at one lesson, a few specimens are brought forward at one time, whilst progress is made with the orders next in the plant-list. It is advisable to confine a lesson to the details of a single order or two, even though each may contain not more than one local species.

The children are now told to look at the Plant-list, and a copy of it is distributed to every two or three for the occasion. They place their fingers upon the Order that was noticed the previous Monday. They then pass on to the next Order, and repeat its name aloud, and are told to remember to learn how to spell it correctly before the following Monday, when they have to write it, (together with the floral schedule exercise), on their slates. If the Order is correctly spelt, one mark is allowed for this part of their performance; but a mark is taken away if no attempt has been made approaching to accuracy. Attention is then called to the few (say half a dozen) dried specimens from the herbarium suspended before them, and all who know their names repeat them aloud. Looking to the Plant-list in their hands, they state how many genera and species belong to the Order about to be noticed. This kind of discipline keeps up their attention, and assists greatly in familiarising them with the names of plants and their classification.

The more prominent characteristics of the Order, the more striking properties of some of its species, whether British or Exotic, and anything interesting or useful, are then exhibited or mentioned. A few questions likely to elicit more or less pertinent answers are interlaced, and for the most part inquisitive eyes and smiling lips prove the time has not been wasted.

ILLUSTRATION VII.

Lens-stand and Lens, with an example of Grass-flowers dissected by one of the Children.



LENS STAND.

[*N.B. This apparatus is intended for a few of the more advanced.*]

A. A block of deal with a base 12 inches by 5, and height 3 inches. This is sloped off at the ends at an angle of 45°.

B. An iron rod $\frac{1}{4}$ inch diameter, and 8 inches long, movable, but fitting rather tightly into the hole at one of the angles of the upper surface of the block. A screw is turned on this rod throughout, except at the lower end where it enters the hole, and at a small portion of the upper end which is flattened, that it may be more readily grasped between the finger and thumb of the right hand.

C. Iron support 5 inches long and 1 broad, perforated with a female screw adapted to (B). When (C) is held

between the finger and thumb of the left hand, (B) is turned with the right, and the support is thus readily raised or depressed. The curved end is to be brought over the middle of the block (A), and adjusted to the focal length of a common lens laid or tied upon the support. Both hands are thus at liberty for the dissection of small objects, as the flowers of grasses.

D and d. An easily prepared handle for a lens, to accompany this lens-stand, can be made of two thin strips of deal. The uppermost (D) is perforated by a centre-bit, with a diameter a trifle larger than that of the lens; and the lowermost (d) with one a trifle smaller. The two strips are glued together with liquid glue, which is allowed to cover the space (d) upon which the lens is dropped through the upper hole in (D), and on which it will thus be retained firmly.

E. A piece of broad tape passed round the handle (D) and glued to it beneath, but not attached to it above. If the iron support (C) be thrust through the vacant space between (E) and (D), the lens will be steadily supported. To secure the right dimensions for the free space between (E) and (D), the tape should be stretched and glued, whilst (D) and (C) are kept in contact. There is no difficulty in teaching the first-class children how to dissect the flowers of grasses. The example exhibited with this illustration proves how soon they learn to do so neatly. The result was obtained after a very few essays.

The next two illustrations refer to an important part of our plan, viz. the "home exercises," extracted (and not unpleasantly) from those who become ambitious of success.

ILLUSTRATION VIII.

Sixteen Examples selected from a large Heap (in Suffolk vocabulary) *of Label-schedules prepared out of school hours, during* 1856-7 *; also three forms of Label-schedule subsequently adopted for securing improved results.*

	Cl. *Di.* Div. *Ang.*
	Sec. *Thalamifloral.*
	Ord. *Violanths.*
	Gen. *Violet.*
1*st April*, 1857, *by Susan Laflin.*	Sp. *Sweet.*

The old schedule (in this example) exacted only the classification of a plant and the date when it was obtained. One mark was allowed for every schedule brought to school, provided there was not a single fault in the spelling. A scrap of the plant (no matter how withered) was stuck through the label to show the plant had been really obtained. The labels were mostly prepared on scraps of paper by the children, a few only having been printed by way of example. They copied the terms from their Plant-list, having previously ascertained the name of the plant as they best could from their more enlightened companions, or by inspecting the Plant-stands.

A much more efficient plan of Label-schedule exacts a greater amount of observation in proportion to the progress made by those in the third, second, and first classes respectively; and a higher scale of marking is laid down accordingly. The following examples show what is required for the same plant from children in the three classes respectively.

	Nos.	Bracket the (No.) where parts cohere.
Pistils - -	1	Class - - - *Dicotyledons.*
		Division - - *Angiospermous.*
Stamens -	5	Section - - *Thalamifloral.*
Petals - -	5	Order - - - *Violanths.*
(*Leaves.*) -		Genus - - - *Violet.*
Sepals - -	5	Species - - *Sweet.*

No. 22.	Name - - *Marianne Lister.* Date - - *1st April*, 1857.	3rd Class marks. 3 + 2 + 1 = 6.

Cl. *Di.* : Div. *Ang.* : Sec. *Thalamifloral.*

	Nos.	Cohesions. Proportions.	Or.
$\frac{P}{C}$	$\frac{1}{3}$	Sty. - - *Monogynous.*	*Violanths.*
St. — f. — a.	5	*Pentandrous.*	Gen. *Violet.*
C. P. (P. L.) C. S.	5 5	*Pentapetalous.* *Pentasepalous.*	Sp. *Sweet.*

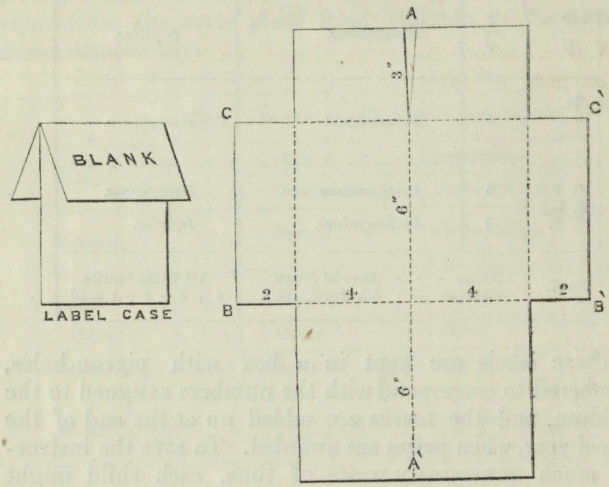
No. 14.	Name - - *Eliza Gooch.* Date - - *5th April*, 1857.	2nd Class marks. 4 + 3 + 1 = 8

Cl. *Di.* : Di. *An.* : Sec. *Th.* : Or. *Vi.* : Gen. *Violet.* Sp. *Sweet.*			
	Nos.	Cohesions. Proportions.	Adhesions (Insertion).
P / C	1 / 3	*Monogynous.*	*Superior.*
St. —f. —a.	5	*Pentandrous.*	*Hypogynous.*
C. P. (P. L.)	5	*Pentapetalous.*	*Hypogynous.*
C. S.	5	*Pentasepalous.*	*Inferior.*
No. 7.	Name - - - *Harriet Sewell.* Date - - - *5th April*, 1857.		1st Class marks. 4 + 3 + 2 + 1 = 10.

These labels are kept in a box with pigeon-holes, numbered to correspond with the numbers assigned to the children, and the marks are added up at the end of the school year, when prizes are awarded. To save the instructor much unnecessary waste of time, each child might be required to arrange its own set of prepared labels according to the Plant-list. The marks might be added up by the pupil-teachers and monitors, each child being allowed to check the result ascertained in its own case. A deduction should be made from the marks assigned to the species of a few extensive Orders where the structure is so uniform that almost every Label-schedule will be exactly, or very nearly the same; otherwise, a large number of marks might be obtained without their having been secured from different Orders. We might deduct $\frac{2}{3}$ of the marks assigned to Composites and Crucifers, $\frac{1}{2}$ from Legumens and Orchidanths, $\frac{1}{3}$ from Grasses, &c.

ILLUSTRATION IX.

Paper Case for Label-schedules.



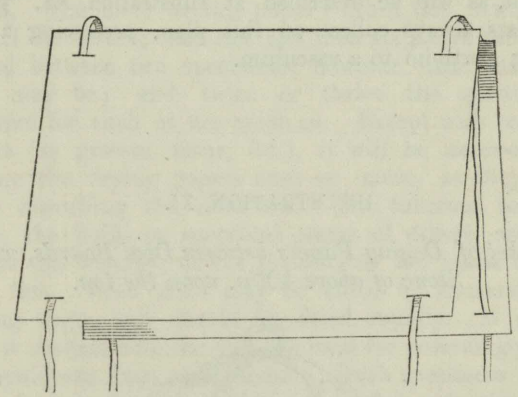
PATTERN FOR LABEL CASE.

This is intended to keep the Label-schedules clean, and to secure them against the risk of any *Mother* lighting her fire with them, should she happen to find them littering about, ignorant of their value. They are readily prepared from pieces of coarse brown paper, 15 inches long and 12 wide. Fold this along the middle A A`. Then along B B`, allowing 6 inches to reach up to a fold along C C`. Cut away the corner-pieces, and slit the upper portion down A A`, as far as the fold C C`. Fold the lower portion up to C C`, and paste over it the two side flaps. Fold backwards along A A`, and paste the backs together. Two pockets are thus formed, with a flap over their entrances. In one of these the Blank-schedules are to be kept, and in the other those which have been filled up, until they can be brought to school. The schedules are doled out by ten at a time, and the loss of any one entails the loss of a mark, and the necessity of a child preparing a blank form for itself.

ILLUSTRATION X.

Collecting Portfolio.

[*N.B. A small tin vasculum is exhibited with it, for the purpose of showing another object well suited for prizes.*]



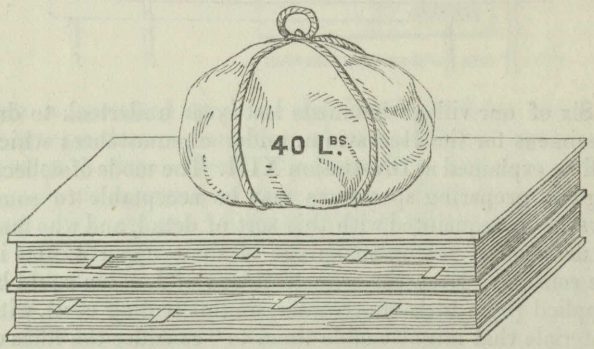
Six of our village botanists last year undertook to dry specimens for the Herbarium, under circumstances which will be explained at Illustration XIII. The mode of collecting and preparing specimens may be acceptable to some persons unacquainted with this sort of detail, and who may be desirous of taking advantage of their opportunities in the country. Even the schoolchildren of London could be supplied (by a little contrivance, and at trifling cost), with materials that might enable them to "consider the lilies of the field, how they grow," and to be taught to deduce just inferences from the abundant revelations recorded in the book of nature.

Although a vasculum is serviceable for ordinary purposes, the few children who dry plants are better and more cheaply supplied with collecting portfolios. They are easily constructed of two pieces of pasteboard 16 inches long, and 10 wide. Four narrow slits are made in each near the corners, and through these two pieces

of tape are so passed that their ends are free and admit of being tied, whilst the middle of each string serves as a sort of hinge or fold. The pasteboards may thus be kept asunder to a varying extent, according as the paper and plants placed between them may require. A few sheets of thick bibulous paper are all that is required. As the plants are gathered, they are laid between these, and the strings are loosely tied. When brought home, the plants are removed, spread between the drying papers, and pressed, as will be described at Illustration XI. Some botanists always collect on this plan, preferring a collecting portfolio to a vasculum.

ILLUSTRATION XI.

A packet of Drying Papers between Deal Boards, with a Stone of above 40lbs. upon the top.



PLANTS UNDER PRESSURE.

The boards and drying papers are 16 inches by 10. This is the size of a half sheet of a convenient form of Bentall's Botanical drying paper, of which a sample is exhibited. Our village drying papers are of very miscellaneous quality. Any thick bibulous paper, such as grocers employ (avoiding common thin blotting paper), is among the most useful; but old newspapers have been

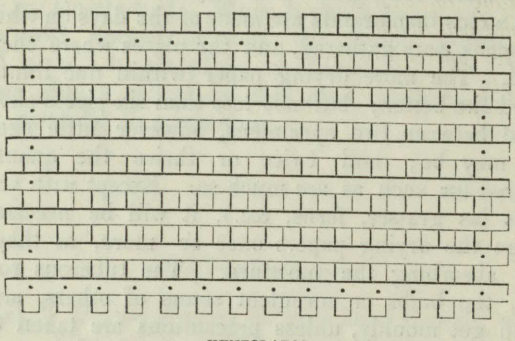
our chief resource. There is great convenience in having all the papers trimmed to the same size. Whoever inspects the specimens in the cabinet (Illustration XIII.), will find evidence that our materials have been sufficient for the purpose. The little loose strips of white paper which project from the packet, direct attention to the places where the plants under pressure are deposited. On these strips memoranda are made of the days on which the specimens were gathered, and the places where they were found. The more drying paper (within due limits) employed the better; but not less than six pieces should be placed between two specimens, however little succulent they may be; and twice or thrice the quantity is required for such as are much so. Except with very dry plants (as grasses, ferns, &c.), it will be necessary to change the drying papers once or more, as they continue absorbing the moisture. The tuberous roots of some, the bulbs or succulent stems of others, are very apt to get mouldy, unless precautions are taken to prevent this. Such parts may be killed by immersion in boiling water, and should be dried rapidly. If dipped into or daubed with the solution used for poisoning plants, no mould can form upon them. Fresh specimens should never be introduced into the same packet with those partially dried, without intercalating a board or pasteboard to intercept the moisture from the recently gathered plants, and thus prevent its reaching the others; or it would inevitably cause them to become mouldy.

ILLUSTRATION XII.

Plant Ventilator.

The drying process may be greatly expedited if, instead of boards or pasteboards, Ventilators are here and there intercalated. These are prepared of narrow strips from a quarter inch deal board. Each strip should be from $\frac{3}{8}$ to $\frac{1}{2}$ inch wide. One set should be 16 inches long, and the other (to cross them at right angles) ten inches

long. This will suit the length and breadth of the drying papers. The longer set being laid parallel to each other, at from $\frac{3}{8}$ to $\frac{1}{2}$ inch asunder, the shorter set are laid upon them at like distances apart. They are riveted together by small pieces of wire, where they cross each other near their extremities.



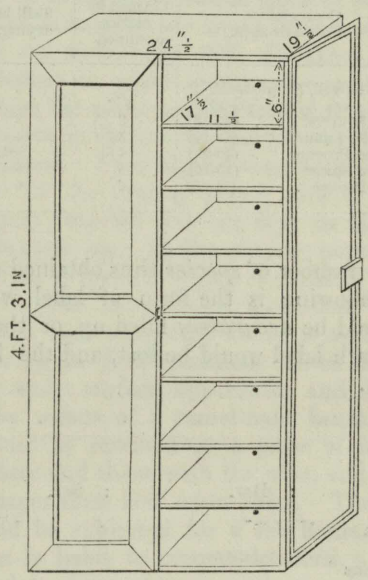
VENTILATOR.

Where a Ventilator is intercalated in the packet, the air can pass between the drying papers in two directions. If the packet is placed in a draught, the process of drying may be reduced to a fourth or less of the time usually required. The packet ought not to be placed very near a fire, or in a very warm oven: for although the specimens may be rapidly dried by these means, they become too brittle for botanical purposes, however prettily they may retain their colour and be adapted for mere show.

ILLUSTRATION XIII.

Herbarium of Local Species in a Deal Cabinet.

[*N.B. The plan and dimensions of the Cabinet here represented, are not those of the Illustration itself, which was made for the purpose of containing only the specimens noticed below. This may be regarded as the best form for special or general Herbaria. One such would be amply sufficient for a local collection, and perhaps two would suffice for an entire British Collection.*]



HERBARIUM CABINET.

Body of half-inch stuff.

Doors will be one inch thick, because of two half-inch planks crossing.

Shelves, thin, of quarter (*or less*) inch stuff.

Doors hung not to interfere with the contiguous cabinet on opening.

One lock and a staple fastens two doors.

N.B. The shelves to be fixed, and not to come within half an inch of the front, in order to allow the inner surface of the doors to fit flush against them, so as to make the whole air-tight.

Hole at the back of each shelf, to allow the vapour of camphor to pass freely.

These specimens were selected from six collections prepared by six of the more advanced botanists during 1856-7. They were prepared in competition for prizes that had been offered on condition that no collection should be admitted to contend which did not include fifty species of plants on the Hitcham Plant-List (Illustration II.) The results obtained were as follows; and considering that this was the first attempt of the candidates to dry plants for the Herbarium, they cannot be regarded otherwise than satisfactory evidences of diligence, attention, and tact.

No. of species dried.	Competitors, and their ages.	Classed by marks obtained.	Skill in drying.	Accuracy in labelling.
265	H. Sewell, (pupil-teacher) . . . (14-15)	1st.	2	1st
190	L. Squirrel . . (12-13)	2	3	6
177	S. M. Laflin . . (13-14)	3	4	2
165	Sus. Procter . . (13-14)	4	1st.	5
159	Sus. Baker . . . (15-16)	5	5	3
114	E. Doorne . . . (14-15)	6	6	4

The whole number of *species* thus obtained amounted to 343. The following is the form of label which it was required should be *accurately* filled up, or the one mark allowed for each label would be lost, and the label was to be re-written.

Cl. : Div. : Sec. :

Order

Genus

Species

Found at Hitcham, Suffolk, on the

of 185 ,

dried }

by }

The specimens were poisoned, and glued to the Herbarium paper, by a young woman of the parish, who has had considerable experience in this sort of work. Either of the six competitors, from their knowledge of plants, might have learnt to do this, at least as efficiently, after a few days' practice.

Where poison is frequently required, it is advisable to keep more corrosive sublimate in quart bottles than will saturate a mixture of rain-water and alcohol in equal proportion. The bottles can then be replenished with the liquid without the trouble of adding the corrosive sublimate from time to time. A rapid and effectual mode of poisoning the dried specimens is to pour the liquid into a shallow dish. If the plants are sufficiently stiff, dip them in it, using a pair of forceps to avoid getting the poison on the fingers. Where the plants are too flaccid to admit of this plan, they should be thoroughly daubed over by means of a camel-hair pencil. They should then be placed between single sheets of the drying paper, and a very slight weight put upon them till they are dry: or the leaves will be apt to crumple up. If the drying papers are once changed, all risk of possible injury is avoided.

In order to glue them down, a common little copper glue pot, heated and supported above a night-light, will be found convenient. Stiff specimens can be held with the forceps, their under surface uppermost, and daubed here and there by means of a camel-hair brush. Flaccid specimens must be reversed on a piece of waste paper, be touched here and there with the glue, and a sheet of Herbarium paper then laid upon them. The glued specimens should be subjected for a few hours to pressure. Where a stem is liable to become detached, a small strip of paper glued or gummed on one side may be laid across it, and it will be held firmly.

The paper employed is stiff cartridge, more suitable and much less expensive than white paper. It is such as is now used for the purpose in the extensive Herbarium at Kew Gardens, and in others elsewhere. The public are not at all aware of the traffic carried on by a few collectors who dry specimens in different parts of the world, charging about sixpence a species for them; neither have they any notion of the importance of extensive Herbaria

to the few eminent men who have made Botany a life occupation: devoting time, thought, and talent of no mean order to the advance of a science whose ultimate aim is to improve our knowledge of the laws which regulate the conditions under which both plants and animals flourish in health, languish under disease, and fade away after death. Our present object has been to deal merely with the *rudiments* of that department of the science which seems, above all other branches of natural science, best adapted for *educational* purposes. These are, indeed, replete with difficulties hard to be overcome by inattentive unobservant minds, but can be mastered without more than ordinary wholesome painstaking, even by young children! Experienced Botanists have cleared the way for us. They have already arrived at certain broad generalities in regard to the structure of plants which beautifully illustrate a "Unity of Design amidst vast Diversity of Detail." Whoever duly respects both the sources of Revelation, his Works and his Word, which God has vouchsafed to his rational creatures, will find ample cause for believing that neither can be ignored or neglected without injury to the legitimate inferences to be deduced from a careful attention to both.

ILLUSTRATION XIV.

Nine coloured Botanical Diagrams, prepared by Prof. H., and drawn by W. Fitch, for the Department of Science and Art.

[*The following extract is from the advertisement of these Diagrams by Messrs. Day, 6, Gate Street, Lincoln's Inn Fields.*]

"These Diagrams are intended to teach beginners how certain important technical terms are employed. The illustrations repeat, as much as possible, the application of the same terms to parts exhibited under those different forms and associations by which plants are either naturally or artificially grouped into large classes, and their subordinate divisions and sections. For each diagram, common plants

of certain prominent orders have been selected, as types of eight groups into which all flowering-plants may be conveniently thrown, for the purpose of exposing the present state of the science. The character selected for designating a particular group is not necessarily applicable to every plant included in it; but the few in which it may not exist will form a very trifling percentage of the whole. The specimens selected for the Diagrams also illustrate the classes and orders of the artificial system of Linnæus. Although this system is at variance with the natural system, it has its use. It is not that beginners can so readily employ it for ascertaining the names of plants, as they are generally induced to imagine; but it serves to direct attention to the flower and fruit, and to familiarise them with certain important, though not the most important, characters upon which a natural classification depends.

With the exception of one, which requires two sheets, each of the eight groups is illustrated by a single Diagram. A general key to the whole is printed on each sheet: so that a short acquaintance with its symbols (always the initial letters of the parts represented) will prevent the inquirer having to refer to and fro for an explanation of every figure. Any botanical character specially illustrated is also noticed on the margin of the several sheets on which it occurs. As many of these characters are repeated, they will not be found so numerous as at first sight might be imagined.

The scale on which the principal illustrations are drawn is sufficiently large for class instruction. They mostly represent a longitudinal section of the flower, and figures of the fruit, seed, and embryo. A portion of the plant in flower (its inflorescence) and also an entire fruit, are drawn of the natural size, to contrast with the magnified illustrations of the dissections. Certain details, figured on a smaller scale than the principal illustrations, can be consulted by nearer approach to the diagrams when the class is dismissed."

During the winter months I have recently employed these Diagrams (in lieu of unprocurable flowering plants) as temporary materials for the label-schedules noticed at illustration (VIII.) A single diagram is allowed to hang

for a week or more in the class-room, that all who choose to avail themselves of the opportunity may fill up their label-schedules by inspecting it.

With regard to the projected "Practical Lessons on Botany," I have been dilatory. This has been owing to various causes, some over which I had no control. But I have also delayed, partly from a desire to mature the plan to which I have been gradually led, and the expediency of some of whose details I wished to test more fully. Until, as I stated in the "Gardeners' Chronicle" last year, my friend B. considered the results obtained worthy of attention, and two of the Government School Inspectors had since expressed the same opinion, I had given the children in our village school instruction in Botany as a useful and not unimportant method of awakening curiosity and improving mental powers of no mean value to any one. But I had treated the subject more as an amusement, than with any such serious interest as I have been gradually led to regard it. I have now become desirous of trying how far it might be made available as a branch of education in all village schools, and I may add in all town schools also. I am convinced it would require very little tact, contrivance, and a trifling expense, to adapt the plan here proposed to schools located in the centre of large cities. It is true there are few teachers at present qualified for working this plan; but if those who desire to employ it will not be in too great a hurry to master the details, there can be no one of moderate ability and attainments who might not in a twelvemonth acquire sufficient knowledge of British Botany to command all that is required for a start; and he will be certain of making rapid progress during a second season. But I fear there may be a greater difficulty than finding teachers to be taught. If I am correctly informed by a desponding friend, there are many teachers not at all willing to learn more than they are already obliged to know, in order to secure their positions. He has tried to introduce Zoology into schools, and has been recommending Patterson's diagrams for the purpose. The ill-success of his efforts he thus deplores. "The great difficulty I have found is with the teachers. They have to become learners before they can attempt to teach. Some are indolent; some

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not disposed to turn to branches of knowledge which they have not been taught to care for; and some teach by the book, and seek not to ascertain if the pupil really understands what is there set down. Natural History should be made part of the course of education in the *training schools;* and its advantages would soon be appreciated."

In my communications to the "Gardeners' Chronicle," I alluded to difficulties in repect to Zoology which do not present themselves in regard to Botany being adopted as an *educational* weapon too little cared for in the schools and universities of England. I need not repeat what I have there said; but I may remark that any one who has learned to appreciate the value of a single classificatory science, becomes well prepared for availing himself of whatever opportunities he may possess of attending to other branches of Natural History. A general museum is no longer to him an unintelligible raree-show; but he can refer from one object to another, *provided the curator has sufficiently labelled them,* deriving positive and useful information from all he sees.

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